

CLAIMS

What is claimed is:

1. A method for time synchronizing a plurality of base stations in a wireless communication system, the method comprising:

determining an estimation of a timing accuracy associated with each base station;

for each base station having its estimation over a threshold:

determining a neighboring one of the base stations having its determined estimation indicating a better timing accuracy than that over threshold base station;

determining an estimated time difference between that over threshold base station and the neighboring one base station;

adjusting a timing of that over threshold base station in response to the estimated time difference; and

updating the estimation of that over threshold base station wherein the updated estimation indicates a worse timing accuracy than the neighboring one base station.

2. The method of claim 1 wherein the estimated time difference is determined by measuring the timing of the neighboring one by the over threshold base station.

3. The method of claim 1 wherein the estimated time difference is determined by measuring the timing of the over threshold base station by the neighboring one base stations.

4. The method of claim 1 wherein the estimated time difference is determined by measuring a time of arrival of the over threshold base station and the neighboring one base station by a user equipment (UE).

5. The method of claim 1 wherein a first base station out of the plurality of base stations is assigned its determined estimation having a best timing accuracy and all other of the plurality of base stations slave their timing to the first base station.

6. A method for time synchronizing a plurality of base stations in a wireless communication system comprising the steps of:

detecting an out of sync base station from said plurality of base stations;

selecting one of a plurality of measurement techniques in order to time synchronize said out of sync base station with said plurality of base stations; said plurality of measurement techniques including:

a measurement of a timing difference of one of said plurality of base stations by said out of sync base station; and

a measurement of the timing difference of said out of sync base station by said one of said plurality of base stations;

conducting a selected measurement in accordance with said selected measurement technique;

comparing said selected measurement to said stored synchronization information; and adjusting said out of sync base station in response to said comparison.

7. The method of claim 6 wherein said synchronization information includes an estimation of the timing accuracy associated with each of said plurality of base stations and a covariance matrix for storage of a set of states associated with each of said plurality of base stations.

8. The method of claim 7 wherein said plurality of base stations includes a first base station wherein said estimation indicates a highest timing accuracy; and

remaining ones of said plurality of base stations having their timing slaved to said first base station.

9. The method of claim 6 wherein said plurality of measurement techniques further includes a measurement of the time of arrival of said out of sync base station and said one of said plurality of base stations by a user equipment (UE).

10. A base station synchronization system for time synchronizing a plurality of base stations in a wireless communication system, said base station synchronization system comprising:

a radio network controller (RNC) for coordinating and synchronizing said plurality of base stations, comprising:

a database for storing synchronization information received from said plurality of base stations; and

a synchronization controller for detecting an out of sync base station from said plurality of base stations, selecting one of a plurality of measurement techniques to time synchronize said out of sync base station to said plurality of base stations, and adjusting a timing of said out of sync base station in response to said selected one measurement technique; and

a measurement device, responsive to said RNC, for conducting said selected one measurement technique, said plurality of measurement techniques including:

measuring the timing of a neighboring one of said plurality of base stations by said out of sync base station; and

measuring the timing of said out of sync base station by said neighboring base station.

11. The system of claim 10 wherein said synchronization information includes an estimation of a timing accuracy associated with each of said plurality of base stations; and a covariance matrix for storage of a set of states associated with each of said plurality of base stations.

12. The system of claim 11 wherein said plurality of base stations includes:
a first base station wherein said timing accuracy estimation indicates a best timing accuracy; and
remaining ones of said plurality of base stations having their timing slaved to said first base station.

13. The system of claim 12 wherein said measurement technique further includes the measurements of a time of arrival of said out of sync base station and said one of said plurality of base stations by a user equipment (UE), said UE comprising a measurement device for measuring said time of arrival of said out of sync base station and said one of said plurality of base stations.

14. A base station synchronization system for time synchronizing a plurality of base stations in a wireless communication system, said base station synchronization system comprising:

a database for storing an estimation of a time accuracy associated with each base station; and

a synchronization controller, responsive to said database, for determining each base station having said estimation of a time accuracy over a threshold, determining a neighboring one of said plurality of base stations having said estimation better than said over threshold base station, adjusting said estimation of said over threshold base station in response to an estimated time difference between said over threshold base station and said

neighboring one base station; wherein the adjusted estimation indicates a worse timing accuracy than said neighboring one base station; and

a measurement device for measuring the estimated time difference.

15. The system of claim 14 wherein the measuring of the estimated time difference is performed by said neighboring base station.

16. The system of claim 14 wherein the measuring of the estimated time difference is performed by said over threshold base station.

17. The system of claim 14 wherein said plurality of base stations includes a first base station wherein said timing accuracy estimation indicate a highest timing accuracy; and

remaining ones of said plurality of base stations having their timing accuracy slaved to said first base station.

18. The system of claim 13 wherein the measuring of estimated time difference is performed by measuring a time of arrival of said over threshold base station and said neighboring one base station by a user equipment (UE), said UE comprising a measurement device for measuring said time of arrival of said out of sync base station and said one of said plurality of base stations.